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(54) **Apparatus and method for identifying multiple transponders**

Vorrichtung und Verfahren zur Identifizierung von mehreren Transpondern

Appareil et méthode pour l'identification d'une multiplicité de transpondeurs

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• **Hagl, Andreas**  
**D-85 221 Dachau (DE)**

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(74) Representative:  
**Schwepfinger, Karl-Heinz, Dipl.-Ing.**  
**Prinz & Partner GbR**  
**Manzingerweg 7**  
**81241 München (DE)**

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(73) Proprietor: **TEXAS INSTRUMENTS**  
**DEUTSCHLAND GMBH**  
**85350 Freising (DE)**

(56) References cited:  
**EP-A- 0 285 419** **EP-A- 0 495 708**  
**EP-A- 0 600 556** **NL-A- 8 802 718**

(72) Inventors:  
• **Orthmann, Kurt**  
**D-80 335 München (DE)**

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## Description

### TECHNICAL FIELD OF THE INVENTION

[0001] This invention relates in general to the field of transponder systems. More particularly, the present invention relates to a method for identifying multiple transponders located in close proximity to one another, and to a transponder system as defined in the precharacterizing portion of Claim 7.

### BACKGROUND OF THE INVENTION

[0002] Transponder arrangements have been used to detect and uniquely identify, in a contactless manner, objects, animals, or persons being present at selected locations. Transponder systems typically include an interrogation unit which transmits radio frequency pulses and a transponder unit which receives the pulses and responds with stored data in the form of a modulated radio frequency carrier. Because the transponders may be diminutive in size, transponder systems may be used in countless applications. For example, luggage being transported on a conveyor belt may be identified and routed according to the encoded destination at a routing point. Machine components may be identified and transported to specific stations on an assembly line. Movement and activity of animal stock with embedded transponder units may be monitored and recorded in an unobtrusive manner. Personnel may carry identification badges having a transponder unit to gain access to secured areas without having to use a card reader.

[0003] However, a problem arises when multiple transponders are simultaneously present within the inquiry field of an interrogation unit. If multiple transponder units exist in the inquiry field and responding simultaneously to the interrogation pulses of the interrogation unit, the responses may become garbled and unreadable. In particular, the resonant circuits of the transponders may interfere with the operation of other circuits so that no transponder response can be read.

[0004] An excess control equipment which comprises a transponder system as defined above is known from EP-A-0 285 419. The identity codes stored in the transponders comprise a plurality of fields each holding a selected information bit. The interrogation signal is controlled so as simultaneously to interrogate the fields of all transponders within range in a serial manner. A group reply signal sent back to the interrogation unit from any transponder having, in the field being interrogated, a bit matching that required by the interrogation signal. The interrogation unit is arranged to determine, from the series of received reply signals, the identity of each and every valid transponder within range. That document further discloses a binary tree search algorithm, which is used for identification of the transponders.

[0005] A similar binary tree search algorithm is known from NL-A-8 802 718.

### SUMMARY OF THE INVENTION

[0006] In accordance with the present invention, apparatus and method for identifying a plurality of transponders are provided which eliminates or substantially reduces disadvantages associated with prior systems.

[0007] In one aspect of the invention, a method for identifying a plurality of transponders located within an inquiry field of an interrogation unit is provided, which comprises the steps defined in Claim 1.

[0008] In yet another aspect of the invention, a transponder system as defined in the precharacterizing portion of Claim 7 has the features of the characterizing portion of Claim 7.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0009] For a better understanding of the present invention, reference may be made to the accompanying drawings, in which:

FIGURE 1 is a simplified diagram showing multiple transponders located in an inquiry field of an interrogation unit;

FIGURE 2 is a simplified flowchart of the process of selectively reading the multiple transponders;

FIGURE 3 is a simplified block diagram of an interrogation unit; and

FIGURE 4 is a simplified block diagram of a transponder.

### DETAILED DESCRIPTION OF THE INVENTION

[0010] The preferred embodiment of the present invention and its advantages are best understood by referring to FIGURES 1-4 of the drawings, like numerals being used for like and corresponding parts of the various drawings.

[0011] FIGURE 1 illustrates an exemplary scenario of multiple transponders 10-16, with identification codes A through D, being simultaneously present in an inquiry field 18 of an interrogation unit 20. Inquiry field 18 represents the area within which the interrogation or power pulses generated by interrogation unit 20 are readily receivable. Inquiry field 18 may contain a continuous modulated or unmodulated radio frequency signal. Transponders 10-16 are capable of receiving the interrogation pulses from interrogation unit 20 and respond thereto with stored data and their respective identification codes. As shown, a transponder 22 located outside of inquiry field 18 does not receive the interrogation pulse and therefore does not participate in transmission of its stored data.

[0012] In a typical transponder system, interrogation unit 20 sends an RF interrogation pulse. The interroga-

tion pulse energizes a transponder located within the inquiry field, and enables it to respond with stored data. However in the scenario shown in FIGURE 1, transponders 10-16 are located in close proximity to one another such that they interfere with one another's operations, and that the simultaneous responses from the transponders may not be readable by interrogation unit 20. As a result, the presence of transponders 10-16 are not properly detected.

[0013] Referring to FIGURE 2, a flowchart of the process in which a plurality of transponders located in an inquiry field are identified by dynamic selective addressing is shown. It may be advantageous to the understanding of the

TRANSPONDER	ID
A	X0001
B	X1000
C	X0100
D	X1100

present invention to also refer to a specific example of transponder identification codes as the logic flow is described. The exemplary identification codes of the transponders are as follows, where "X" represents the most significant bits of the identification code:

[0014] At the start of the algorithm, interrogation unit 20 sends an interrogation pulse, as shown in blocks 30 and 32. A read cycle is then initiated to receive the responses from the transponders, as shown in block 34. If the responses are unrecognizable or unreadable, then a determination is made that more than one transponder are present in inquiry field 18, as shown in block 36. If there are more than one transponder present, then an initiation of a counter, *COUNT*, and a selection bit string is performed. As shown in block 38, *COUNT* is initialized to zero, and the selection bit string is initialized with a zero bit. The identification codes of the transponders may be uniquely assigned 64-bit bit strings where, in most applications, the transmission of a small number of the least significant bits is sufficient to uniquely identify the transponders. In block 40, interrogation unit 20 sends an interrogation pulse including the bit string and the identification bit string of any successfully read transponders. The identification code or bit string of successfully read transponders may be stored in a memory and deleted after a predetermined time period to enable the detection of a re-entry into the inquiry field. In addition, selection bit strings that have been transmitted in the selection procedure are also stored in memory and deleted after a predetermined amount of time.

[0015] Upon reception of the interrogation pulse with the bit string, each transponder 10-16 compares the bit string with the least significant bits of its own unique identification code. In this case, since the bit string is "0", those transponders with identification codes ending

in "0" respond to the interrogation pulse, and those transponders having identification codes ending in "1" do not respond. Therefore, transponder A with its identification code ending in "0001" is prevented from sending its reply, and transponders B through D send their responses and their identification codes. The read cycle of interrogation unit 20 once again tries to read the transponder responses, as shown in block 42. However, it discovers that there are more than one transponder present, as shown in block 44. In block 46, if the counter, *COUNT*, is not zero then it is reset. In block 48, a "0" is added to the most significant bit of the bit string to form "00". This new selection bit string is sent in the interrogation pulse, as shown in block 40, where the responses from transponders B through D again indicate multiple transponders with this identification code ending in "00", as shown in blocks 42 and 44. The bit string is again modified by adding another "0" to form "000". This time, the response to the interrogation pulse indicates only one transponder replied, since transponder B is the only transponder in this scenario to have the identification code ending in "000". Transponder B is therefore identified by the interrogation unit, and its identification code is stored in a memory.

[0016] The selection bit string must again be modified to progressively select the remaining transponders. Since it is determined, in block 44, that only one transponder responded to the "000" bit string, execution proceeds to block 50 where the bit string is examined to determine whether it is only one bit long. The bit string contains three bits presently, therefore execution proceeds to block 52. In blocks 52, the counter, *COUNTER*, is checked to determine whether it is greater than zero. If it is not, as in this case, then the counter is incremented by one in block 54, and execution proceeds to block 58, where the most significant bit of the bit string is inverted. The resultant bit string becomes "100". The new selection bit string is checked to determine whether it has been used previously. This bit string is then transmitted with the interrogation pulse. In addition, the identification code of the successfully read transponder, "000", is also sent to deselect transponder B. Note that although the format of the interrogation pulse is not explicitly described herein, it necessarily follows that some format is used in which the successfully read transponder identification codes may not be confused with the selection bit string.

[0017] In response to the selection bit string of "100", both transponders C and D respond, since both of their identification codes end with this bit string. The determination in block 44 is therefore answered in the affirmative, and the counter, *COUNT*, is reset in block 46. In block 48, a "0" is added to the selection bit string to form "0100". This new bit string is sent with the identification codes of successfully read transponders, resulting in suppressing responses from transponders A, B, and D, and the selection of transponder C. Transponder C is therefore detected and identified in block 42. In block

44, since only transponder C responded to the interrogation pulse, the bit string is examined to determine whether it is only one bit long. Since the answer is no, and *COUNT* is not greater than zero, *COUNT* is incremented, as shown in block 54. In block 58, the most significant bit of the selection bit string is inverted to form "1100". Since this new bit string has not been used previously, it is transmitted in an interrogation pulse resulting in the selection and identification of transponder D. [0018] In block 44, since only transponder D responded to the interrogation pulse, execution proceeds to block 50, where it is determined that the bit string length is longer than one. In block 52, *COUNT* is checked to determine if it is greater than zero. Since it is, the least significant bit in the selection bit string is removed. The resultant selection bit string is "110". Because no transponder identification code has this bit string ending, no response is received, and the least significant bit of the bit string is removed again in block 56. The resultant bit string, "11" also does not solicit any response, causing the execution to go to block 50. Because the bit string is longer than one bit, and *COUNT* is still greater than zero, the least significant bit is again deleted to yield "1". When the selection bit string "1" is transmitted, transponder A responds since its least significant bit is "1". Therefore, transponder A is identified and read in block 42. In blocks 44 and 50, it is determined that there is not more than one transponder and the bit string length is only one bit long. Accordingly, execution stops. In this manner, all four transponders are identified and their respective data are read.

[0019] In summary, the selection bit string sequence generated by the procedure and the resultant transponder selection are as follows:

0	- selecting B, C, and D
00	- selecting B, C, and D
000	- selecting B
100	- selecting C, and D
0100	- selecting C
1100	- selecting D
110	- selecting none
11	- selecting none
1	- selecting A

[0020] Operating in this manner, a dynamically grown series of bit strings are used to exhaustively select and read the transponders present in the inquiry field. The transponders are deselected based on the bit string ending in their identification codes not matching those transmitted in the interrogation pulses. Alternatively stated, the transponders respond to the interrogation pulses only when their respective codes has the same bit string ending as those transmitted in the interrogation pulses. The bit strings are constructed and manipulated according to an algorithm which is capable of singling

out all the transponders present in the inquiry field. Because the algorithm operates on bit strings, it accomplishes the task faster than one that selects and compares on a bit-by-bit basis. Furthermore, since the identification codes of successfully read transponders are also transmitted along with the selection bit string, a faster detection of yet undetected transponders is possible.

[0021] Referring to FIGURE 3, a simplified block diagram of an embodiment of an interrogation unit 70 is shown. Interrogation unit 70 includes a microprocessor 72 which is responsible for the control of the function sequences. Microprocessor 72 is coupled to a memory 74, which may include the aforementioned queue used for storing the identification codes of recognized transponders. Further included are a transmitter 76 and receiver 78. Transmitter 76 and receiver 78 may include a radio frequency (RF) oscillator (not shown) and a resonant circuit (not shown). For a description of the construction and operation of an embodiment of the interrogation unit, please refer to U.S. Patent No. 5,053,774, titled *Transponder Arrangement*, issued to Schuermann et al. on October 1, 1991.

[0022] FIGURE 4 is a simplified block diagram of an embodiment of a transponder 90. Transponder 90 includes a resonant circuit 92 coupled to an energy accumulator 94. Resonant circuit 92 may include a receiving coil (not shown) coupled in parallel with a first capacitor (not shown). Energy accumulator 94 may include a second capacitor (not shown) coupled in series with resonant circuit 92. A controller 96 with memory 98 are also provided. Controller 96 may receive input signals from a sensor (not shown) indicative of certain physical parameters of the environment, for example ambient temperature and pressure, and store it in memory 98 for transmission to the interrogation unit. The unique identification code of the transponder also may be stored in memory 98. In addition, a response formulator 100 may read memory 98 to formulate the code pattern responses to the interrogation pulses. A de-energizer circuitry 102 controlled by controller 96 is further provided for shorting, discharging, or by-passing energy accumulator 94 in response to receiving an interrogation pulse containing the least significant bits of its identification code. De-energizer circuitry 102 therefore acts to suppress the transponder's response so that it may not respond to the interrogation pulse. Details of an embodiment of the transponder circuitry are described in above-identified U.S. Patent No. 5,053,774, titled *Transponder Arrangement*.

[0023] Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made therein without departing from the scope of the invention as defined by the appended claims.

## Claims

1. A method for identifying a plurality of transponders comprising the steps of:

5 assigning a unique identification code to each one of said plurality of transponders; dynamically building and modifying a bit string and transmitting said bit string to said transponders; 10 permitting responses from those transponders having identification code endings equal to said transmitted bit string; suppressing responses from those transponders having identification code endings different 15 from said transmitted bit string; repeating said bit string building, modifying and transmitting step and response permitting and suppressing step until only one transponder response is received and said transponder identified thereby; and 20 repeating said bit string building, modifying and transmitting step and response permitting and suppressing step until all of said plurality of transponders are identified; wherein said bit 25 string building and modifying step comprises increasing the number of bits in said bit string by adding a bit of a predetermined logic value to a most significant bit position when more than one transponder responds to said transmitted bit string; 30 inverting the logic value of a most significant bit after successfully identifying a transponder; and decreasing the number of bits in said bit string 35 by deleting a bit from a least significant bit position when no more than one transponder responds to said transmitted bit string more than once successively. 40

2. The method, as set forth in Claim 1 further comprising the step of transmitting a bit string ending of those successfully identified transponders, and suppressing said responses from those transponders having identification code endings equal to said transmitted bit string ending. 45

3. The method, as set forth in Claim 1 or Claim 2, further comprising the step of comparing said transmitted bit string and least significant bits of each of said transponder identification codes. 50

4. The method, as set forth in any preceding claim, further comprising the step of storing said identification codes of successfully identified transponders. 55

5. The method, as set forth in Claim 4, further comprising the step of deleting said stored identification

codes after a predetermined time period.

6. The method, as set forth in any preceding claim, further comprising the step of storing said transmitted bit strings.

7. A transponder system comprising:

an interrogation unit (70) comprising:

a processor (72) dynamically building and modifying a bit string; a transmitter (76) transmitting an interrogation pulse including said bit string receivable within an inquiry field (18); and a receiver (78) receiving a transponder response; and a plurality of transponders (10,...,16) located in close proximity with one another within said inquiry field (18), each transponder (10,...,16) comprising:

a memory (98) storing a unique identification code; a circuit (92) receiving said interrogation pulse, said interrogation pulse including said bit string; and transmitting a response in response to least significant bits of said stored identification code being equal to said bit string; a controller (96) comparing said received bit string with said least significant bits of said identification code; and a de-energizer circuit (102) suppressing said receiving/transmitting circuit (92) from transmitting a response in response to said least significant bits of said identification code being unequal to said bit string;

wherein building and modifying said bit string is accomplished by

increasing the number of bits in said bit string by adding a bit of a predetermined logic value to a most significant bit position when more than one transponder responds to said transmitted bit string;

inverting the logic value of a most significant bit after successfully identifying a transponder; and

deleting a bit value at a predetermined bit position in said bit string after only one transponder responds to said transmitted bit string more than once successively; **characterized in that**

said processor (72) decreases the number of bits in said bit string by deleting a bit from a least significant bit position when no more than one transponder responds to said transmitted bit string more than once successively; and that said receiving/

transmitting circuit (92) in each transponder (10,..., 16) is a resonant circuit.

8. The system, as set forth in Claim 7, wherein said interrogation unit (70) further comprises:

a memory (74) storing bit strings eliciting response from only one transponder.

#### Patentansprüche

1. Verfahren zum Identifizieren mehrerer Transponder, das die folgenden Schritte umfaßt:

Zuweisen eines eindeutigen Identifizierungscodes zu jedem der mehreren Transponder;

dynamisches Aufbauen und Modifizieren eines Bit-Strings und Sendens des Bit-Strings zu den Transpondern;

Zulassen von Antworten von jenen Transpondern, deren Identifizierungscode-Endungen gleich dem gesendeten Bit-String sind;

Unterdrücken von Antworten von jenen Transpondern, deren Identifizierungscode-Endungen von dem gesendeten Bit-String verschieden sind;

Wiederholen des Schrittes des Aufbaus, Modifizierens und Sendens des Bit-Strings und des Schrittes des Zulassens und Unterdrückens von Antworten, bis nur noch eine Transponderantwort empfangen wird und der Transponder dadurch identifiziert ist; und

Wiederholen des Schrittes des Aufbaus, Modifizierens und Sendens des Bit-Strings und des Schrittes des Zulassens und Unterdrückens von Antworten, bis jeder der mehreren Transponder identifiziert ist; wobei der Schritt des Aufbaus und Modifizierens des Bit-Strings umfaßt:

Erhöhen der Anzahl von Bits in dem Bit-String durch Hinzufügen eines Bits mit vorgegebenem logischen Wert an der höchstwertigen Bitposition, wenn mehr als ein Transponder auf den gesendeten Bit-String antwortet;

Invertieren des logischen Wertes des höchstwertigen Bits, nachdem ein Transponder erfolgreich identifiziert worden ist; und

Erniedrigen der Anzahl von Bits in dem Bit-String durch Löschen eines Bits an der niedrigstwertigen Bitposition, wenn nicht mehr als ein Transponder auf den gesendeten Bit-String mehr als einmal nacheinander antwortet.

2. Verfahren nach Anspruch 1, das ferner den Schritt des Sendens einer Bit-String-Endung jener erfolgreich identifizierten Transponder und des Unterdrückens der Antworten von jenen Transpondern, deren Identifizierungscode-Endungen gleich der gesendeten Bit-String-Endung ist, umfaßt.

3. Verfahren nach Anspruch 1 oder Anspruch 2, das ferner den Schritt des Vergleichens des gesendeten Bit-Strings mit den niedrigstwertigen Bits jedes der Transponder-Identifizierungscodes umfaßt.

4. Verfahren nach einem vorhergehenden Anspruch, das ferner den Schritt des Speicherns der Identifizierungscodes der erfolgreich identifizierten Transponder umfaßt.

5. Verfahren nach Anspruch 4, das ferner den Schritt des Löschens der gespeicherten Identifizierungscodes nach einer vorgegebenen Zeitperiode umfaßt.

6. Verfahren nach einem vorhergehenden Anspruch, das ferner den Schritt des Speicherns der gesendeten Bit-Strings umfaßt.

7. Transponder-System, das umfaßt:

eine Abfrageeinheit (70), die umfaßt:

einen Prozessor (72), der einen Bit-String dynamisch aufbaut und modifiziert;

einen Sender (76), der einen den Bit-String enthaltenden und innerhalb eines Abfragefeldes (18) empfangbaren Abfrageimpuls sendet; und

einen Empfänger (78), der eine Transponder-Antwort empfängt; und

mehrere Transponder (10, ..., 16), die sich innerhalb des Abfragefeldes (18) sehr nahe beieinander befinden, wobei jeder Transponder (10, ..., 16) umfaßt:

einen Speicher (98), der einen eindeutigen Identifizierungscode speichert;

eine Schaltung (92), die den den Bit-String enthaltenden Abfrageimpuls

empfängt; und als Antwort auf die Gleichheit zwischen niedrigstwertigen Bits des gespeicherten Identifizierungs-codes und dem Bit-String eine Antwort sendet;

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einen Controller (96), der den empfangenen Bit-String mit den niedrigstwertigen Bits des Identifizierungs-codes vergleicht; und

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eine Aberregungsschaltung (102), die die Empfangs/Sende-Schaltung (92) als Antwort auf die Ungleichheit zwischen den niedrigstwertigen Bits des Identifizierungs-codes und dem Bit-String davon abhält, eine Antwort zu senden; wobei das Aufbauen und Modifizieren des Bit-Strings erzielt wird durch

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Erhöhen der Anzahl von Bits in dem Bit-String durch Hinzufügen eines Bits mit einem vorgegebenen logischen Wert an einer höchstwertigen Bitposition, wenn mehr als ein Transponder auf den gesendeten Bit-String antworten;

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Invertieren des logischen Wertes eines höchstwertigen Bits, nachdem ein Transponder erfolgreich identifiziert worden ist; und

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Löschen eines Bitwertes an einer vorgegebenen Bitposition in dem Bit-String, nachdem nur ein Transponder auf den gesendeten Bit-String mehr als einmal nacheinander geantwortet hat;

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#### **dadurch gekennzeichnet, daß**

der Prozessor (72) die Anzahl von Bits in dem Bit-String erniedrigt, indem er ein Bit an der niedrigstwertigen Bitposition löscht, wenn nicht mehr als ein Transponder auf den gesendeten Bit-String mehr als einmal nacheinander antwortet; und

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die Empfangs/Sende-Schaltung (92) in jedem Transponder (10, ..., 16) eine Resonanzschaltung ist.

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8. System nach Anspruch 7, bei dem die Abfrageeinheit (70) ferner umfaßt:

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einen Speicher (70), der Bit-Strings speichert, die eine Antwort von nur einem Transponder bewirken.

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#### **Revendications**

1. Procédé pour identifier une pluralité de transpondeurs comprenant les étapes consistant à :

affecter un code d'identification unique à chacun de ladite pluralité de transpondeurs;

construire et modifier de façon dynamique une suite de bits et transmettre ladite suite de bits auxdits transpondeurs;

permettre des réponses à partir de ceux des transpondeurs qui comportent des fins de code d'identification égales à ladite suite de bits transmises;

supprimer des réponses provenant de ceux des transpondeurs qui ont des fins de code d'identification différentes de ladite suite de bits transmises;

répéter ladite étape de construction, modification et transmission de la suite de bits et l'étape d'autorisation et de suppression de réponse jusqu'à ce que seule une réponse d'un transpondeur soit reçue et que ledit transpondeur soit ainsi identifié; et

répéter ladite étape de construction, de modification et de transmission de la suite de bits et ladite étape d'autorisation et de suppression de réponse jusqu'à ce que l'ensemble de ladite pluralité de transpondeurs soient identifiés; dans laquelle ladite étape de construction et de modification de la suite de bits comprend

l'augmentation du nombre de bits dans ladite suite de bits par addition d'un bit ayant une valeur logique prédéterminée à une position de bit de poids le plus élevé lorsque plus d'un transpondeur répond à ladite suite de bits transmise;

l'inversion de la valeur logique d'un bit de poids le plus élevé après l'identification réussie d'un transpondeur; et

la réduction du nombre de bits dans ladite suite de bit par suppression d'un bit à partir de la position de bits de poids le plus faible lorsqu'au plus un transpondeur répond plus d'une fois successivement à ladite suite de bits émise.

2. Procédé selon la revendication 1, comprenant en outre l'étape de transmission d'une fin de suite de bits de ces transpondeurs identifiés avec succès, et de suppression desdites réponses provenant des transpondeurs ayant des fins de codes d'identification identiques à ladite fin de suite de bits transmise.

3. Procédé selon la revendication 1 ou la revendication 2, comprenant en outre l'étape consistant à comparer ladite suite de bits transmise et des bits de poids le plus faible de chacun desdits codes d'identification de transpondeurs. 5
4. Procédé selon l'une quelconque des revendications précédentes, comprenant en outre l'étape consistant à mémoriser lesdits codes d'identification de transpondeurs identifiés avec succès. 10
5. Procédé selon la revendication 4, comprenant en outre l'étape consistant à supprimer lesdits codes d'identification mémorisés après un intervalle de temps prédéterminé. 15
6. Procédé selon l'une quelconque des revendications précédentes, comprenant en outre l'étape consistant à mémoriser lesdites suites de bits transmises. 20
7. Système de transpondeur comprenant :
- une unité d'interrogation (70) comprenant :
- un processeur (72) construisant et modifiant de façon dynamique une suite de bits; 25
- un émetteur (76) émettant une impulsion d'interrogation incluant ladite suite de bits pouvant être reçue dans une zone de demande (18); et 30
- un récepteur (78) recevant une réponse du transpondeur; et 35
- une pluralité de transpondeurs (10, ..., 16) situés à proximité directe les uns des autres dans ladite zone de demande (18), chaque transpondeur (10, ..., 16) comprenant : 40
- une mémoire (98) mémorisant un code d'identification unique;
- un circuit (92) recevant ladite impulsion d'interrogation, ladite impulsion d'interrogation incluant ladite suite de bits; et émettant une réponse en réponse à l'égalité entre des bits de poids le plus faible dudit code d'identification mémorisé et ladite suite de bits; 45
- un contrôleur (96) comparant ladite suite de bits reçue auxdits bits de poids le plus faible dudit code d'identification; et 55
- un circuit de désexcitation (102) empêchant ledit circuit d'émission/réception (92) d'émettre une réponse en réponse à l'inégalité entre lesdits bits de poids le plus faible dudit code d'identification et ladite suite de bits;
- dans lequel la construction et la modification de ladite suite de bits sont accomplies par accroissement du nombre de bits dans ladite suite de bits par addition d'un bit ayant une valeur logique prédéterminée à une position de bit de poids le plus élevé lorsque plus d'un transpondeur répond à ladite suite de bits transmise;
- inversion de la valeur logique du bit de poids le plus élevé après une identification réussie d'un transpondeur; et
- suppression d'une valeur de bit dans une position de bit prédéterminée dans ladite suite de bits après que seul un transpondeur ait répondu plus d'une fois successivement à ladite suite de bits émise;
- caractérisé en ce que**
- ledit processeur (72) réduit le nombre de bits dans ladite suite de bits en supprimant un bit d'une position de bit de poids le plus faible lorsqu'au plus un transpondeur répond plus d'une fois successivement à ladite suite de bits émise; et que ledit circuit de réception/d'émission (92) dans chaque transpondeur (10, ..., 16) est un circuit résonnant.
8. Système selon la revendication 7, dans lequel ladite unité d'interrogation (70) comprend en outre :
- une mémoire (74) mémorisant des suites de bits déclenchant une réponse à partir uniquement d'un transpondeur.



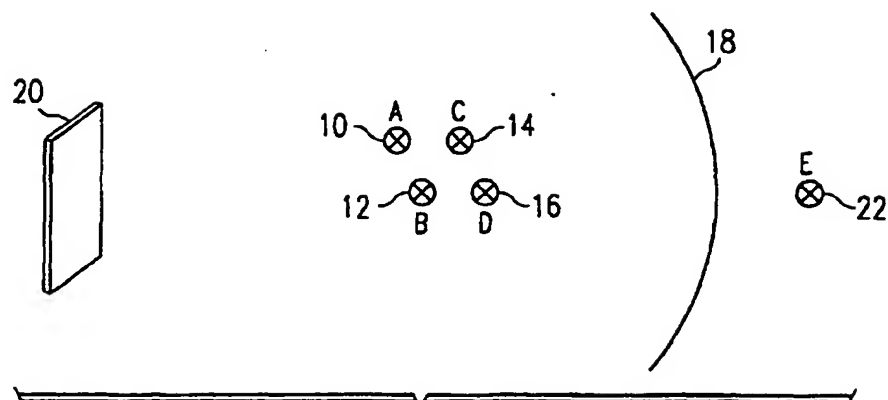


FIG. 1

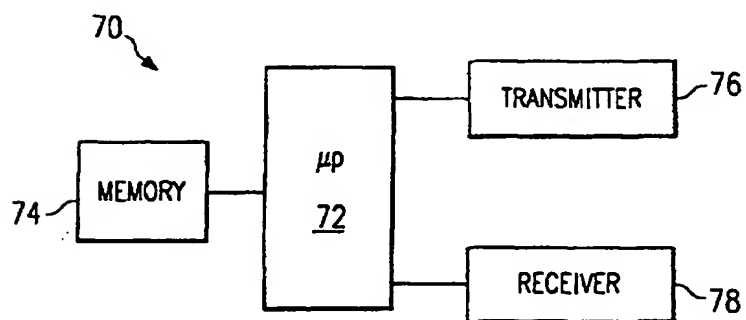


FIG. 3

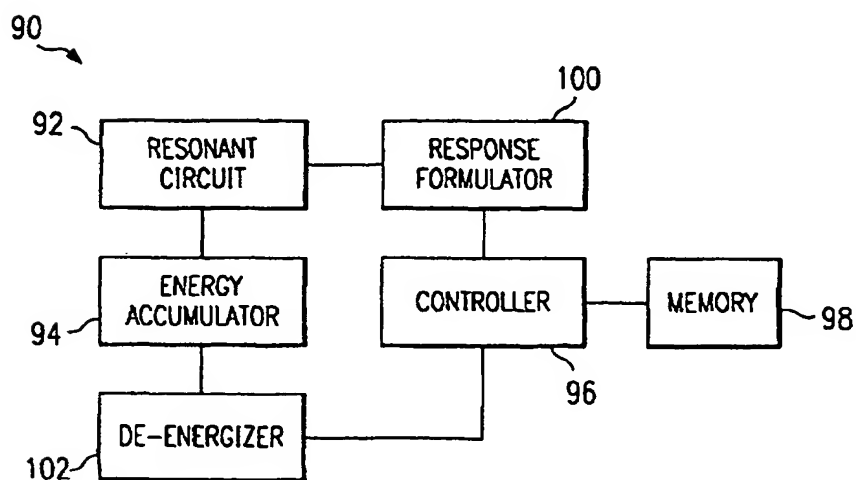


FIG. 4

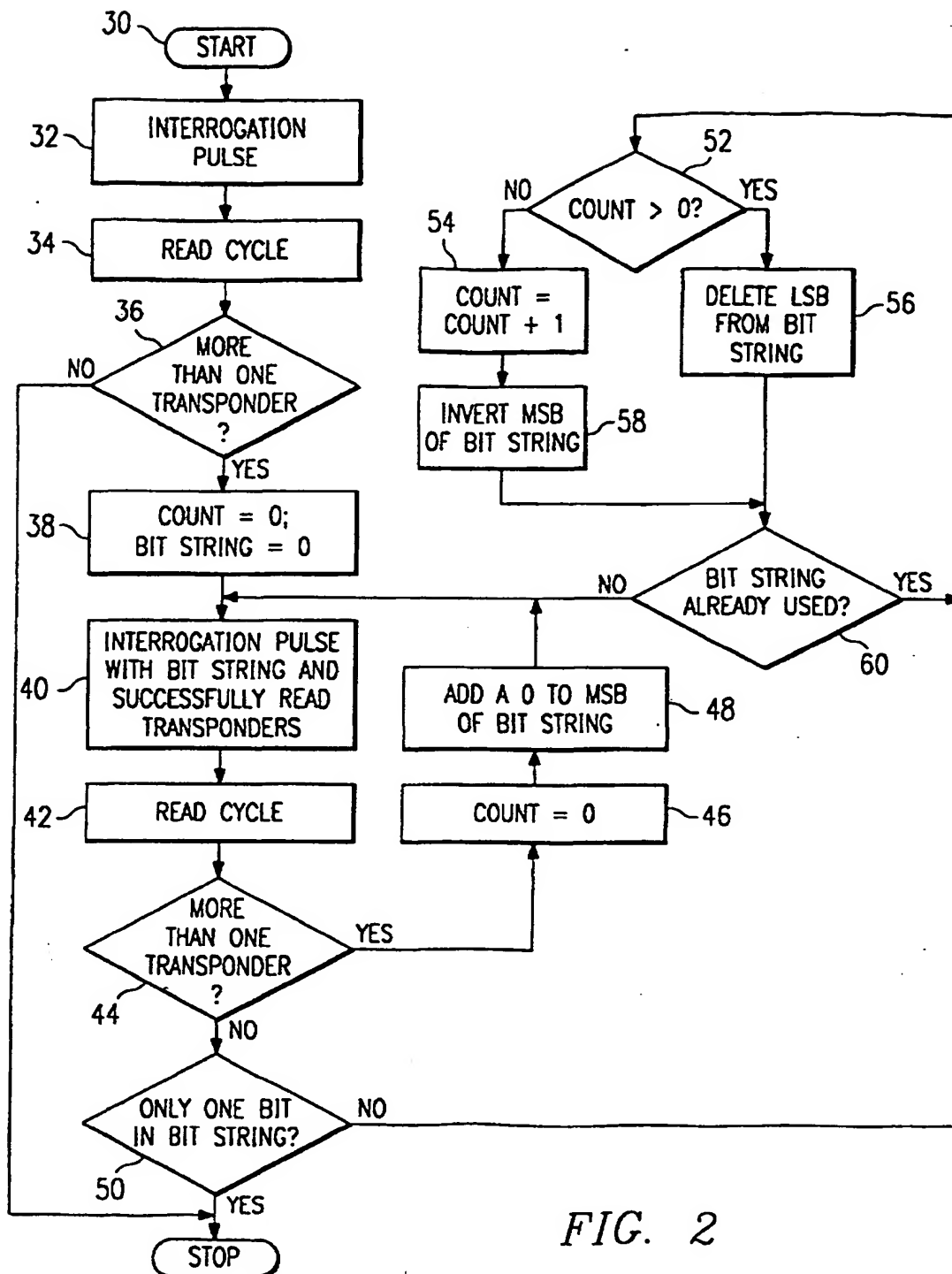


FIG. 2